Chapter XIII
PQoS Assessment Methods for Multimedia Services

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ABSTRACT

The concept of PQoS, although in general it deals with the user satisfaction with a specific delivered/ requested service, is in practice significantly differentiated by the nature of each delivered service. This chapter reviews various existing PQoS assessment methods for video, VoIP, online games, and Web services that have been published in the literature. It then moves beyond the current PQoS assessment methods and presents novel techniques for predicting the PQoS of a multimedia service.

INTRODUCTION

The term quality of service (QoS) has been widely used in various IT services throughout time, from traditional ones, such as those related to telephony to more recent ones (e.g., those provided over IP networks). Although multiple definition of QoS concept exists (one such a detailed compilation can be found in (ITU-T, 2004a)), most of the proposed definitions agree on considering quality of service as "a set of characteristics related to the performance of the elements that provide the services that have an effect into final end users perception."

Since different services may be affected by a different set of parameters, some kind of categorization of QoS is necessary. This has led to the definition of the traffic and service classes, with each of them corresponding to a different subset of parameters. However, most of traditional

QoS assessment and management architectures handle a **technical only** subset of these parameters (only network performance is considered here) (Xilouris, Kourtis, & Stefanou, 2005).

On the other hand, as early as 1994, ITU-T E.800 recommendation (ITU-T, 1994) included a more user-centric definition of Quality of Service as "*the collective effect of service performance, which determines the degree of satisfaction of a user of the service.*"

Therefore, the term QoS makes a step beyond pure performance-related concepts, such as network performance (NP) or service performance (SP). Yet, when Internet services are the focus point, NP is found to be one of the most significant factors due to the high variability of the performance parameters in data networks today. Inherent characteristics of these networks, such as non-connection-oriented or best effort properties, make the provision of a minimum level of guaranteed NP a complex issue. As a result, the research community has focused, during the last two decades, on the so-called *"Technical QoS" (TQoS) or "Network QoS" (NQoS),* trying to solve the problem of assuring an accurate performance level to end-users.

The QoS perceived as user satisfaction has received less effort from the research community through past years. One of the first formal inclusions of QoS as perceived by users of Internet services was in ETSI ETR 003, (ETSI, 1994) wherein a quality matrix was proposed to relate network and service performance to the quality of service perceived by end users. This approach was later adopted by ITU-T (ITU-T, 2004a). In both recommendations, ETSI and ITU-T brought together objective aspects related to Network Performance and their subjective impact on user satisfaction.

Thus, NP parameters are key issues in QoS, however, these parameters have to be considered together with other factors (such as codecs, source/terminal mechanisms) for an overall user satisfaction or an end-to-end perceived QoS (PQoS).

Furthermore, a common vision of the future communication networks is the provision of multimedia or audiovisual content at a variety of quality and price levels (Seeling, Reisslein, & Kulapala, 2004). The evaluation of the PQoS will provide an end user with a range of potential choices, covering the possibilities of low, medium, or high quality levels. This PQoS evaluation will also give the service provider and network operator the capability to minimize the storage and network resources by allocating only the ones that are necessary to maintain a specific level of user satisfaction (Gardikis, Kourtis, & Constantinou, 2003).

Further, the success of providing novel multimedia services over wired/wireless networks depends on how good the quality of the service is and whether it meets or not an end user's satisfaction standards. Thus, it is critical for equipment manufacturers, network operators and service providers to assess, predict and possibly control the end-to-end perceptual multimedia (e.g., voice and video) quality for commercial and technical reasons. Developing accurate, efficient and robust PQoS models for multimedia services remains a challenging research target both in academia and industry.

In this context, the chapter deals with PQoS assessment methods for modern multimedia applications/services. The objectives of the chapter are (1) to describe general subjective quality assessment models, (2) to review the up-to-date PQoS assessment models for multimedia services such as Web, video and VoIP services; (3) to propose and present novel PQoS prediction models for Web, video, VoIP, and online gaming services, and (4) to present future trends on PQoS models. The work and the PQoS models presented in the chapter will be useful in developing and monitoring PQoS-aware multimedia devices and networks, and for PQoS monitoring, prediction, and control of live multimedia services over IP and mobile networks.

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